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Title of the Invention: INTERMITTENT TRANSFERRING METHOD OF LIQUID CRYSTAL POLYMER

[Claim 1]

An intermittent transferring method, wherein, when transferring a long liquid crystal polymer layer that is formed on a long aligned substrate film onto a long optically transmittable substrate film via an adhesive, the adhesive for adhering the liquid crystal polymer layer and the optically transmittable substrate film is applied and adhered so as to have a width that is larger than a width of the liquid crystal polymer layer formed on the long aligned substrate film, and subsequently is released and transferred.

[0007] The present invention will be further described below. In the present invention, a material to be laminated is a polymer that exhibits liquid crystallinity, and is a thermotropic liquid crystal polymer that exhibits liquid crystallinity at the time of being melted. As the optical element, an optical element that exhibits uniform and mono-domain nematic liquid crystallinity or twisted nematic liquid crystallinity is preferably used. The thermotrapic liquid crystal polymer selected here is a liquid crystal polymer that performs the nematic alignment or the twisted nematic alignment in a liquid crystal state, and is in a glass state within a temperature region that is a liquid crystal transition temperature or lower. As the polymer that exhibits the nematic liquid crystallinity, principal chain-type liquid crystal polymers such as polyester, polyamide, polycarbonate and polyesterimide; and side chain-type liquid crystal polymers such as polyacrylate, polymethacrylate, polymalonate and polysiloxane can be exemplified. Further, optically active liquid crystal

polymers that are obtained by copolymerizing an optically active unit with main chains or side chains of these liquid crystal polymers, and liquid crystal polymer systems that are obtained by blending low molecular-weight or high molecular-weight optically active compounds and the like can be exemplified. Among them, in the light of the easiness of the synthesis, the alignment and the glass transition point, polyester is preferably used. As the polyester to be used, aromatic polyester such as half or total aromatic polyester is preferably used.

[0030] On a long aligned substrate that is obtained by being subjected to a rubbing treatment in a direction parallel to the longitudinal direction or in a slanting direction having a predetermined angle with respect to the longitudinal direction, a liquid crystal polymer layer is formed, subsequently is heated at a predetermined temperature for a predetermined period of time so as to align the liquid crystal polymer, and thereafter is cooled to a temperature of Tg or less so as to fix the liquid crystal structure. A film thickness of the liquid crystal polymer layer after being fixed is not limited particularly. It differs depending on a wavelength of light, but is 0.1 μm or more, preferably is 2 μm or more, more preferably is 3 μm or more, in a field where visible light for displaying is important, for example. The film thickness of less than 0.1 μm is not preferable because it is difficult to adjust the film thickness with high precision. Moreover, it is not preferable that the film thickness is too large, because the controlling power as the optical element becomes weak, in the light of this viewpoint, an appropriate range of the film thickness is 1000 μm or less, and a preferable range is 500 μm or less. In the present invention, since the aligned substrate positioned underneath is the long aligned substrate that is subjected to the rubbing treatment at the predetermined angle, a long liquid crystal polymer film that is aligned at an angle corresponding to this rubbing treatment can be obtained.

[0031] The optically transmittable substrate film is not limited particularly, as long as it has transparency and optical isotropism, and can support the liquid crystal polymer layer, but, since the optically transmittable substrate film is required to be long, plastic films, for example, polymethylmethacrylate, polystyrene, polycarbonate, polyethersulfone,

polyphenylenesulfide, polyarylate, polyethylenesulfide, amorphous polyethylene, cellulose triacetate and the like can be exemplified. Moreover, a thickness of the film for the substrate ranges from 0.5 μm to 200 μm, and preferably ranges from 1 μm to 100 μm.

[0032] Next, a process for intermittently transferring the liquid crystal polymer layer that is formed on the long aligned substrate film obtained as described above onto the long optically transmittable substrate film by using an adhesive will be described. The adhesive is applied onto at least one of the liquid crystal polymer layer that is formed on the long aligned substrate film or the long optically transmittable substrate film, and both of the long substrate films are attached to each other via the adhesive, thereafter, the adhesive is cured, thereby forming a laminate film composed of the aligned substrate film / the liquid crystal polymer layer / the adhesive layer / the optically transmittable substrate film. Next, by intermittently releasing only the aligned substrate film from this laminate film, the liquid crystal polymer layer is intermittently transferred from the aligned substrate film to the optically transmittable substrate film side.

[0033] The adhesive used here is not limited particularly, but preferably is a photo-curing or electron beam-curing adhesive, considering that the adhesive can be cured in an extremely short period of time which is required for the intermittent transfer, and can be cured at a temperature of Tg of the liquid crystal polymer or less. In particular, an adhesive containing an acrylic oligomer as a main component is preferable, because it causes reduced incorrect transfer of the liquid crystal polymer layer, does not cause any trouble at the time of operations such as winding, and gives high reliability to the optical element manufactured as a product. Further, it is also possible to blend a polarized vinyl monomer such as N-vinylpyrrolidone with this acrylic oligomer.

CONTINUOUS TRANSFER METHOD OF LIQUID CRYSTAL POLYMER

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Abstract of **JP7120620**

PURPOSE:To make it possible to fully transfer a liquid crystal polymer layer at the time of transfer and prevent the generation of a crack and the like due to a defect and distortion caused by the fine pieces of a liquid crystal polymer layer by applying an adhesive for bonding the liquid crystal polymer layer to a transmissive base film, wider than the width of the liquid crystal polymer layer formed on a long-sized orientation base film. CONSTITUTION:At the time of transferring a long-sized liquid crystal polymer layer, formed on a long-sized orientation base film, onto a long-sized light transmissive base film through an adhesive, the adhesive for bonding the liquid crystal polymer layer to the light transmissive base film is applied wider than the width of the liquid crystal polymer layer, formed on the long-sized orientation base film, for bonding, and then separation and transfer are performed. In a laminated film obtained by a continuous transfer method being formed of the liquid crystal polymer layer, a hardening adhesive layer and the light transmissive base film, the liquid crystal polymer layer applied to the orientation base film can be fully transferred by applying the adhesive wider than the width of the liquid crystal polymer layer so as to eliminate the generation of a crack, the separation of a liquid crystal polymer, and the like.